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National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

RESEARCH INFORMATION REPORT TO SUPPORT DSEIS ON ENDANGERED AND THREATENED SPECIES OF SEA TURTLES, 1981

REPORT: Incidental Catch and Mortality of Loggerhead Sea Turtles for the Shrimp Trawl Fishery of the Southeast U. S.

FOR: Southeast Regional Office, NMFS, St. Petersburg, FL

BY: Southeast Fisheries Center, NMFS, Miami, FL

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Incidental Catch and Mortality of Loggerhead Sea Turtles by the Shrimp Trawl Fishery of the Southeast U. S.

INTRODUCTION

This report reviews research data collected on the incidental catch and mortality of loggerhead sea turtles in the shrimp trawl fishery of the southeast United States. The two sources of data used in this report are from (1) Sea Turtle Excluder Trawl Development Project, 1978 - present, and (2) Sea Turtle Incidental Catch and Mortality Project, 1979 - present. During both of these projects, observers were placed on board commercial shrimp vessels to record commercial catch data and to record (and resuscitate, if needed) incidentally caught sea turtles. The data have been summarized into the following four areas of the southeast:

(1) South Atlantic - South Carolina, Georgia, East Florida

(2) West Florida - Key West, FL to Pensacola, FL

(3) Northeast Gulf - Pensacola, FL to Mississippi River

(4) Northwest Gulf - Louisiana from Mississippi River to Texas

The data have been summarized for each of these four areas (1) mean sea turtle capture rates, (2) total estimated sea turtle captures, (3) total estimated sea turtle mortalities, and (4) total estimated sea turtle mortalities with resuscitation. These values are primarily for loggerhead sea turtles, which comprised 95.1% of the sea turtles caught. All of the data presented were collected from approximately 1-30 fathoms, the average depth varing with and depending on the area. No data were collected from inshore fisheries located in bays, sounds and estuaries.

METHODS

Sea Turtle Incidental Catch and Mortality Project: Beginning in late 1979, NMFS observers have worked on board commercial shrimp trawlers during actual fishing operations.

The observers record number and species of turtle captures, their condition (dead, alive, comatose, and injuries), as well as the location, length of tow, and gear size. Turtles are also measured, tagged, and released. Comatose turtles are resuscitated, if possible.

Sea Turtle Excluder Trawl Development Project: Sea Turtle excluder trawls have been tested on chartered and cooperating commercial shrimp trawlers since 1978. Paired tows were made with an experimental excluder trawl on one side of the vessel and an identical standard control trawl on the other side. Data for this report were only obtained from the standard trawl. As in the incidental catch and mortality project, NMFS observers worked on board the vessel to monitor trawl performance, and record the number and species of turtles captured, their condition, catch location, length of tow, and gear size. Turtles were measured, tagged, and released. Resuscitation techniques were employed if the turtles was comatose.

RESULTS

Figure 1 is a computer graph of all tows recorded for both projects. The effort represents over 8,000 tows and over 24,000 hours of actual fishing time. Figure 2 is a graph of 411 sea turtles captured during the tows. (391 loggerheads, 16 Kemp's ridleys, and 4 greens). Net sizes (headrope length) varied from 45 - 75 feet during the excluder trawl project, and 38 - 80 feet in the incidental catch project. Usually, catch data were obtained from only one net during the excluder trawl project and from two nets (up to four nets) during the incidental catch project.

Data from the two projects should be considered with some caution. The data were not collected randomly either spatially or temporally. Cooperating vessels had to be obtained on an as-available basis, although efforts were made to locate in certain areas. In addition, the primary objective of the excluder trawl project was to develop and test sea turtle excluding gear, and test areas were selected to obtain turtle and shrimp capture information for gear evaluations.

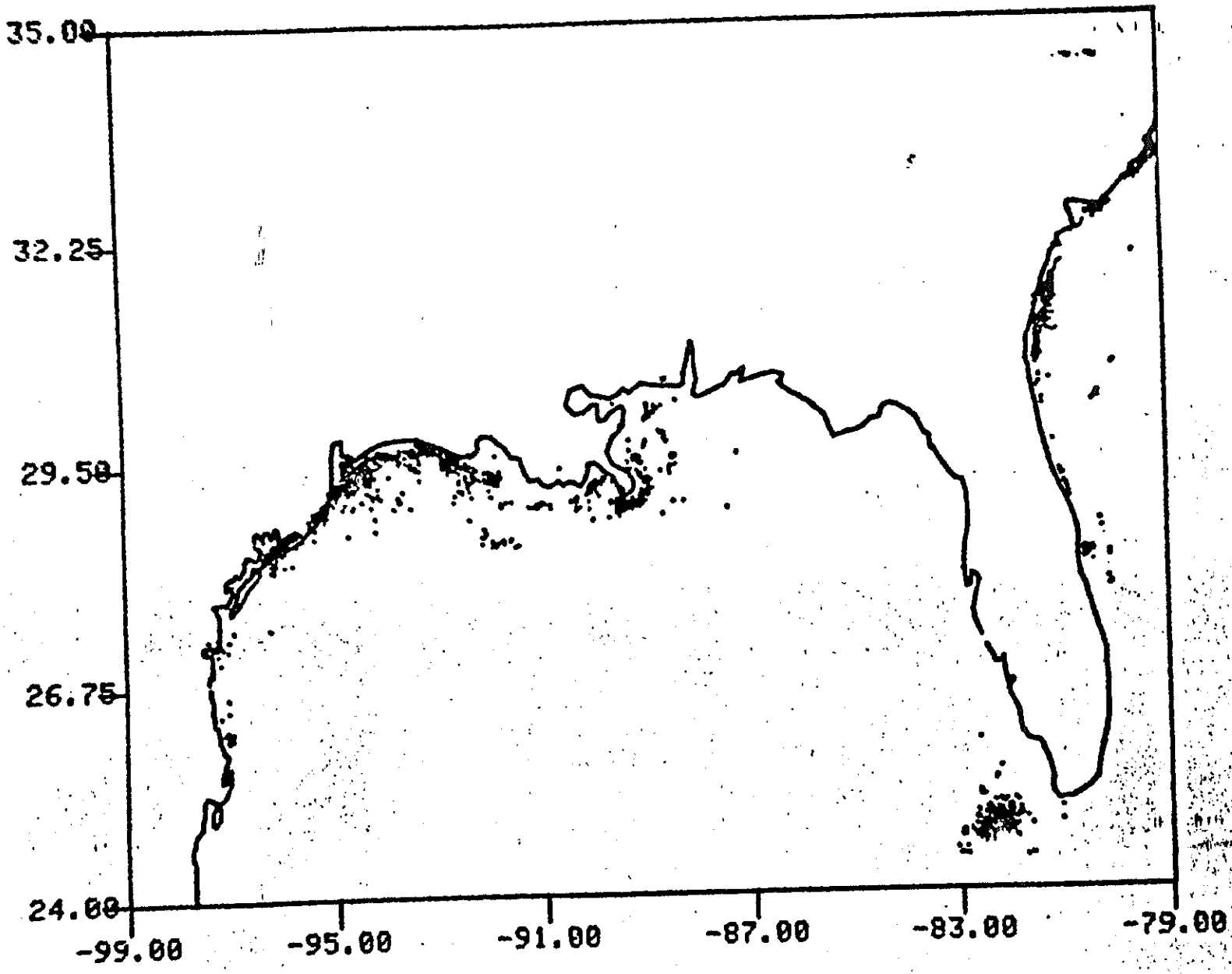

Figure 1. Location of trawling stations occupied during the excluder trawl and incidental catch projects representing more than 8,000 tows and 24,000 fishing hours.

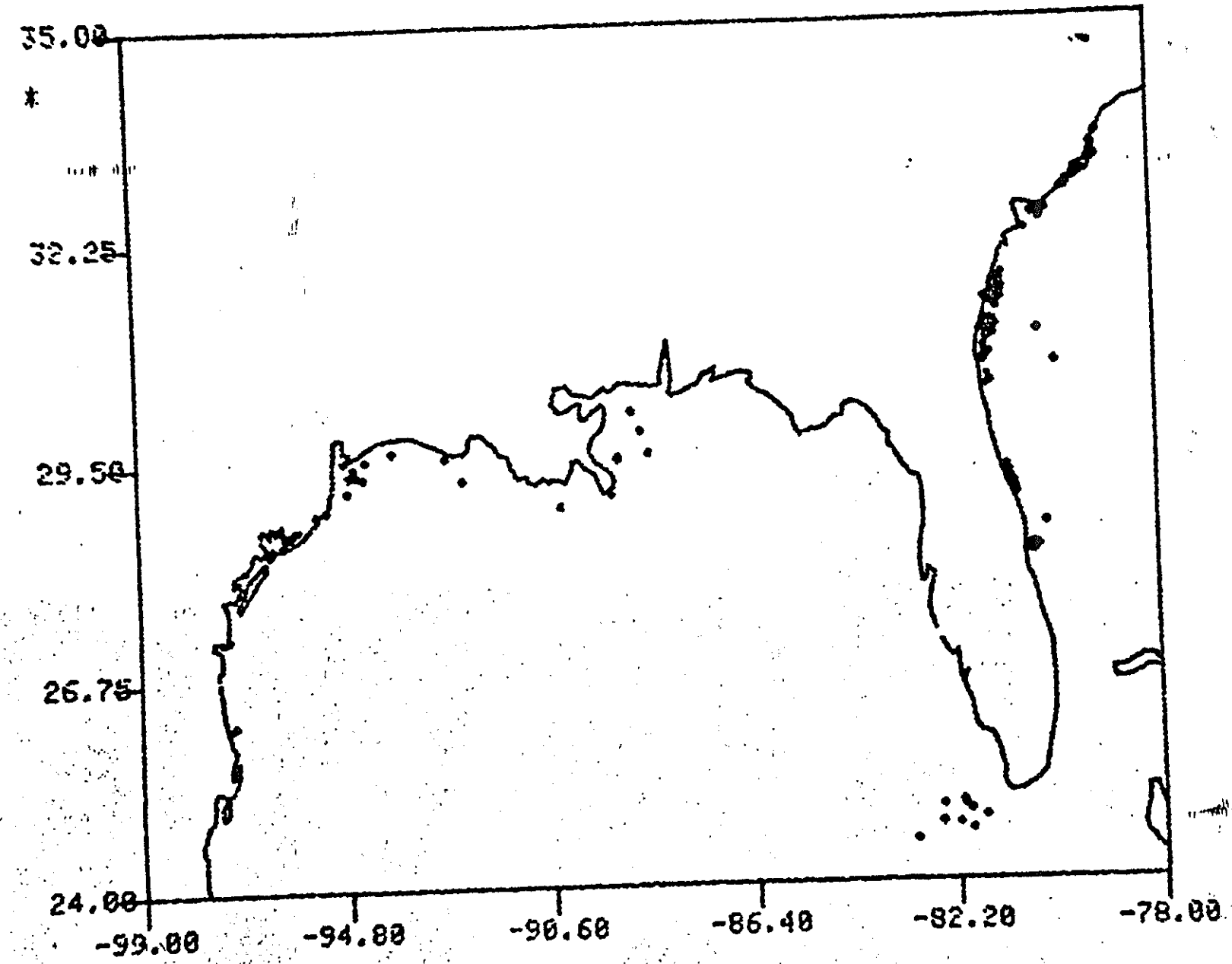

Figure 2. Location of sea turtles captured during the excluder trawl and incidental catch projects(391 loggerheads,16 Kemp's ridleys, and 4 greens).

The catch rates developed, however, are probably representative of the areas worked.

Table 1 summarizes loggerhead sea turtle catch data from the four areas. The mean estimated catch rates are 0.0447 turtles per hour for the South Atlantic and 0.003 for the Gulf of Mexico, or one turtle caught every 22.4 trawling hours in the South Atlantic and 333.3 hours in the Gulf of Mexico. Because various net sizes were used by the commercial vessels, catch rates for the two projects were normalized to 100 feet of trawl headrope length. Normalization was done by dividing each catch rate by the length of the headrope and multiplying the quotient by 100.

The number of days of fishing effort for the four areas were estimated. (See attached Supplement). Estimates were normalized to days of fishing with 100-foot headrope length trawls to correspond to turtle catch rate data (Table 1). Days of fishing were converted to hours of fishing by multiplying the TIMS estimates by nine /1 for the south Atlantic and 14 /1 for all Gulf of Mexico areas. These multipliers represent point estimates of the number of hours fished per day by vessels in the two respective areas. The average headrope lengths used by TIMS for their normalizations follow:

South Carolina	- 137.4 feet
Georgia	- 153.6 feet
East Florida	- 123.0 feet
West Florida	- 119.5 feet
Alabama	- 124.0 feet
Mississippi	- 139.0 feet
Louisiana	- 100.0 feet
Texas	- 131.0 feet

/1 In addressing sea turtle capture rates, total time that the trawl is in the water is considered.

Table 1. Summarized loggerhead turtle catch rates (turtles/hour/100 ft. of headrope) by project and geographical area based on data from excluder trawl and incidental catch projects

Data Source	Number of Tows (n)	Mean Capture Rate (X)	Variance (s^2)
	South Atlantic		
Excluder Trawl	4212	0.045	0.044
Incidental Catch	603	0.046	0.015
TOTAL	4816	0.045	0.040
	West Florida		
Excluder Trawl	535	0.006	0.003
Incidental Catch	56	0.008	0.002
TOTAL	492	0.007	0.003
	Eastern Gulf		
Excluder Trawl	0	0	0
Incidental Catch	484	0.005	0.002
TOTAL	484	0.005	0.002
	Western Gulf		
Excluder Trawl	1753	0.002	0.001
Incidental Catch	476	0.004	0.001
TOTAL	2229	0.003	0.001

Normalized turtle catch rates were combined from the two data sources and used with the normalized 1980 effort estimates to estimate annual number of turtle captures for the four areas (Table 2). The range of turtles caught in regions of the Gulf of Mexico are: W. Florida 878-5,002; E. Gulf 193-2,302; and W. Gulf 1,793-6,317. It should be emphasized, however, that these estimates do not include turtles caught by the inshore shrimp fleets which may be significant in the northern Gulf.

The turtle capture estimates given in Table 2 should be used cautiously for several reasons. Primary among these is the lack of randomness in the catch data which may tend to bias the estimates upward in the south Atlantic and downward in most of the Gulf of Mexico areas. Additionally, the effort estimates (both days and hours of fishing) were assumed to exsist without error. How this assumption affects the capture estimates is unknown, although its overall effect would be to significantly influence the precision of the estimates. In other words, the confidence limits associated with the capture estimates would increase if estimates of the errors associated with effort data had been available.

Estimates for the number of dead loggerhead turtles taken by the shrimp fleets in the four areas are presented in Table 3. These estimates are presented without any estimate of error. They were derived based on average tow times recorded for the four areas by both projects (Table 4). The tow times were assumed to correspond to comatose and dead percentages found during the Excluder Trawl Project as summarized in Figure 3. A discussion of these percentages including methods, rationale, and results is given in another special report. It should be noted that the percent dead and number of dead turtle estimates are valid only if resuscitation is performed on all comatose turtles.

Table 2. Estimated Annual Number of Loggerhead Turtle Captures.

Area	Estimated Normalized Hrs. Effort*	Normalized Mean Capture Rate (± 95% Confidence Limits)**	Estimated Mean No. of Turtle Captures	95% Lower Est. Numbers	95% Upper Est. Numbers
S. Atlantic	264,141	0.04473 ± 12.63%	11,815	10,328	13,312
W. Florida	438,788	0.00668 ± 70.05%	2,931	878	5,002
E. Gulf	242,326	0.00514 ± 84.57%	1,245	193	2,302
W. Gulf	2,037,840	0.00199 ± 55.89%	4,055	1,793	6,317
Gulf of Mexico	2,718,954		8,231	2,864	13,621

* Hours of fishing normalized to 100 ft. of headrope.

** Turtles per hour per 100 ft. of headrope.

Table 3. Estimates of the annual total, comatose, and dead loggerhead turtles taken in the southeastern shrimp fisheries

Area	Total Captures	Comatose*	Dead
S. Atlantic	11,815	3,652	1,653
W. Florida	2,931	1,484	740
Northeast Gulf	1,245	433	202
Northwest Gulf	4,055	2,053	1,024
Totals	20,046	7,622	3,619

*Comatose turtles include those that could not be resuscitated; i.e., dead turtles.

Table 4. Average tow times (hours) and corresponding estimates for the percent of comatose and dead loggerhead turtles captured in shrimp trawls

Area	Average Tow Times (Hours)	Percent Comatose	Percent Dead
South Atlantic	2,4399	30.91	13.89
West Florida	4,0409	50.64	25.26
Northeast Gulf	2,7530	34.81	16.22
Northwest Gulf	4,0299	50.64	25.26

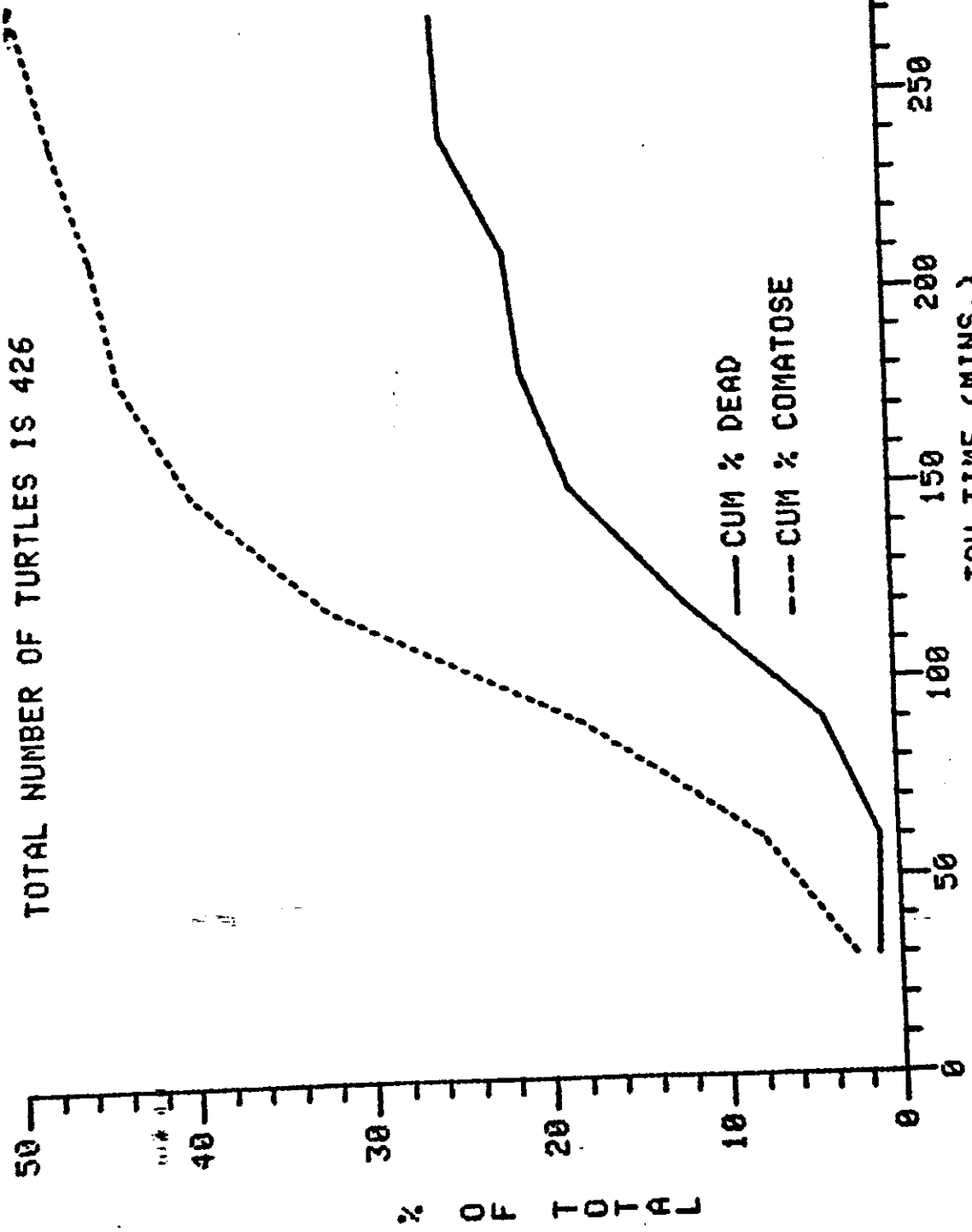

Fig. 3. Cumulative mortality with resuscitation for loggerhead sea turtles with increasing shrimp trawl tow time. Presented as cumulative percent dead and cumulative percent comatose in 30 minute grouped intervals.

This is due to the requirement imposed on vessel observers to attempt to revive all turtles taken. If the assumptions are made that all comatose turtles will die without resuscitation, and that only a limited number of fishermen actively use resusciation techniques, then the number of comatose turtles given in Table 3 would represent the best estimate for annual turtle mortality directly or indirectly attributable to shrimp trawlers.

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SUPPLEMENT to the REPORT on: Incidental Catch and Mortality of Loggerhead Sea Turtles for the Shrimp Trawl Fishery of the Southeastern U. S.

Estimates of Standardized Shrimp Trawl Hours

Estimates are presented of standardized shrimp trawl hours by state for the Gulf and South Atlantic by year. As noted in the text, even this level of detail represents a considerable amount of effort on our part. We have had to aggragate information from two different data collection systems and carry out a special survey to obtain some of the required data. If monthly detail is required, the amount of additional effort required will be rather prodigious.

There is a real need to define the level at which we are going to respond to the DSEIS. The analytical problems involved in the turtle-shrimp interaction would completely occupy my time for several months and maybe years if they were to be adequately addressed. It cannot be emphasized too strongly that this is a very very difficult analytical problem and requires someone's full concentration and dedication. I see an ever increasing tendency to utilize TIMS in the analytical role for this problem which concerns me greatly. Once enmeshed it will become impossible to extricate ourselves and the time required in just communicating with the large number of players in this game will completely overwhelm us.

The use and interpretation of shrimp effort data in regard to the DSEIS must be very carefully considered. There are rather serious limitations in the data we collect which restrict the kinds of analyses or projections which can be made. The shrimp effort data which would be potentially relevant to an investigation of shrimp-turtle interaction is some subset of the total data which we collect. Including shrimping times or areas or depth zones where no natural interaction exists because of turtle distribution and fishing behavior may, for example, prevent the detection of any relationships which might exist.

The present system of data collection for shrimp involves converting landings by port or dealer to catch by area using vessel and boat interviews i.e. some landings within a statistical grid may result from catches outside and some catches inside a grid may be landed outside. Interview levels usually do not exceed 25% and are not uniform over area and time. Thus the variability involved in catch, effort, CPUE, etc. decreases as the interview level and/or the size of the areal-temporal strata of interest increase.

The selection of the time-area strata which involve shrimp-turtle interaction will, it seems to me, be a developmental or experimental process so that estimates of error limits for any biological parameter of interest are, at present, impossible.

There are, however, some common characteristics of catch data which seem to be almost universal. They arise primarily from the tendency of fish and fishermen to aggregate in time and space and from the fact that increasing gear or vessel size raises the potential upper limit while the lower (zero) remains intact. The result is that the variability in any natural system is almost always a function of the mean and the variability within some smaller time-area strata be just as large as in a much larger system. In the data presented here, I use these kinds of relationships to try to develop measures of variability which would aid in establishing some limits on estimates of shrimping effort for any selected subset.

Background:

In the data presented here, estimates of shrimping effort are based upon determinations of standardized CPUE. For the data collection system used for shrimp in the Gulf of Mexico, vessels are identified with landings and can be matched to a vessel characteristics or operating units file containing information on gear size. In the South Atlantic, vessel identifiers are not permitted in landings data files so that standardized effort information must be obtained by special surveys. In the present instance, data was obtained by locating those dealers for which net size could be determined for all vessels landing at a site. In all cases, days fished is standardized to 100 ft. of net i.e. actual days are increased or decreased by the ratio total net length/100. Total landings and standardized effort are accumulated for each state for all interviewed (or surveyed) vessels or trips as shown in Table 1. Estimated standard effort for non-interviewed trips are obtained by dividing non-interview landings by the CPUE obtained from selected trips. Column 8 is the total of actual interview (col 3) and estimated non-interview (col 7) effort.

Available data:

For Georgia, South Carolina and North Carolina average net length and landings were obtained from all dealers for which all vessels landing during the year could be identified. As shown in Table 1, the average catch for a standard days fishing for all states combined was 473.24 with a standard deviation of 146.4 pounds/day or 31% of the mean catch rate. The estimate of variability (standard deviation) in this case represents the variability in standardized catch per day from dealer to dealer. In the Gulf of Mexico, estimates of standardized catch were obtained from

from interview files by state for the years 1978 and 1979. The average standardized catch for this period was 488.16 lbs/day with a standard deviation of 141.45 or 28.9% of the mean catch. In this case, the estimates of error are based on the variability in standardized catch per day from state to state over a two year period. In table 1, col 8, total estimated standardized days fished are determined from each state for each year. Estimates are based upon average CPUE's for the Gulf (488.16 pounds per day) and the South Atlantic (473.24 pounds per day). Averages are used because individual estimates subject to high variability as a result of low interview rates give unrealistic estimates of effort. This approach may give underestimates of effort in poor years or areas and over estimates when actual catch rates are unusually high. Total estimated standard bottom time hours (12 hr Gulf and 7.5 hr. S.A.[1]) for the Gulf and South Atlantic for the years 78-80 are shown below.

	78	79	80
S.A.	177,772	299,678	316,789
Gulf	2,819,664	2,423,304	2,308,992

Interpretation of variability:

As noted above, meaningful estimates of variability for individual (by state) estimates of effort are at present impossible. Several questions involving the representativeness of the interviewed sample need to be carefully examined. It should be noted that the relative variability or coefficient of variation for the standardized catch per day $s/\hat{x}$ is the same (approx 30%) among dealers in the S.A. for a single year as among estimates determined by summing all information for each state. For the usual 95% level of confidence, limits if applied would be $\hat{x} + .6\hat{x}$ or $.4\hat{x} - 1.6\hat{x}$. This is close

[1] When addressing shrimp harvest, only bottom time is considered.

to the half or double rule common in many kinds of fishery data and represents, I believe, the most optimistic limits which can be applied to individual state estimates. For grouping of a number (n) of states the more general formulae for the lower and upper limits are

$$\hat{x}\left(1-\frac{.60}{\sqrt{n}}\right) \text{ and } \hat{x}\left(1+\frac{.60}{\sqrt{n}}\right)$$

		Interview			Non-interview		
State	Yr	Standardized Days Fished	Pounds Landed (millions)	Average lbs/day	Pounds Landed	Estimated Days Fished	Total Estimated Days Fished
W Fla.	78	5238	3.45	657.9	14.06	28,802	34,040
E Fla.	78	-	-	-	2.69	5,510	5,510
Ala	78	3765	1.92	509.6	10.10	20,690	24,455
Miss	78	220	.14	660.3	1.05	2,151	2,371
Lou	78	7241	4.80	663.5	36.80	75,385	82,626
Tex	78	14,989	7.06	471.0	37.34	76,491	91,480
W Fla	79	3909	2.10	536.8	14.70	30,113	34,021
E Fla	79	159	.17	1060.2*	5.43	11,123	11,282
Ala	79	2276	.85	372.7	9.35	19,153	21,430
Miss	79	337	1.32	391.3	.56	1,147	1,484
Lou	79	7639	2.53	331.6	30.07	61,599	69,238
Tex	79	19,783	5.67	286.8	27.33	55,986	75,769
W Fla	80**	-	-	-	15.30	31,342	31,342
E Fla	80	-	-	-	4.69	9,608	9,608
Ala	80	-	-	-	8.02	16,429	16,429
Miss	80	-	-	-	.92	1,885	1,885
Lou	80	-	-	-	32.63	66,842	66,842
Tex	80	-	-	-	37.06	75,918	75,918
Ga.	78	-	-	-	3.54	7,480	7,480
	79	-	-	-	6.24	13,186	13,186
	80***	985.37	.28	309.35	5.06	10,692	11,677
SC	78	-	-	-	3.23	6,825	6,825
	79	-	-		4.25	8,981	8,981
	80	732.59	.27	387.00	3.47	7,332	8,064
NC	78	-	-		1.84	3,888	3,888
	79	-	-		3.08	6,508	6,508
	80	1,796	.87	524.51	5.25	11,094	12,890

*Not included in determining average catch rate
**Interview data not available
***Average calculated on a per dealer basis

NO TURTLES FOLLOWING IN S-NFTP
NO TURTLES FOLLOWING IN S-NFTP
NO TURTLES FOLLOWING IN S-NFTP
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These 11 turtles are included in the total of 411 from which the mean is calculated for the 4 areas. The 11 are not included in the totals by species, but they are loggerheads.

RATES NORMALIZED TO 100 FT. NET AND HOUR TOW TIME

GRAND TOTALS

NUMBER OF TOWS IS 8119

NUMBER OF TURTLES IS 411

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.027869	29.4982	254.28	3.0116
VARIANCE	0.024739	1446.6344	216781.72	2.3062
SUM OF X	226.270481	239496.26	2064463.3	24451.15
SUM OF X2	207.139292	18808497.75	2284776544.0	92358.51

RATES NORMALIZED TO 100 FT. NET AND HOUR TOW TIME

AREA TOTALS

SOUTH ATLANTIC

NUMBER OF TOWS IS 4815 NUMBER OF TURTLES IS 379

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.044732	27.5874	269.18	2.4399
VARIANCE	0.040031	1568.0599	238689.80	0.7838
SUM OF X	215.386553	132633.40	1296104.6	11747.88
SUM OF X2	202.343391	11213170.50	1497938896.0	32436.27

WEST FLA COAST

NUMBER OF TOWS IS 591 NUMBER OF TURTLES IS 9

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.006686	27.0164	238.50	4.0409
VARIANCE	0.003375	441.0365	332968.43	3.1015
SUM OF X	3.951157	15966.68	140955.1	2388.15
SUM OF X2	2.017418	691573.65	23006540.0	11480.09

NORTHEAST GULF

NUMBER OF TOWS IS 484 NUMBER OF TURTLES IS 6

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.005147	39.1324	447.20	2.7530
VARIANCE	0.002367	1652.7131	547220.54	2.4109
SUM OF X	2.491311	18940.08	216444.8	1332.45
SUM OF X2	1.165750	1539431.34	361101620.0	4832.70

NORTHWEST GULF

NUMBER OF TOWS IS 2229 NUMBER OF TURTLES IS 17

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.001993	32.1920	184.37	4.0299
VARIANCE	0.000720	1370.8911	53814.46	3.3259
SUM OF X	4.441462	71756.08	410958.9	8982.67
SUM OF X2	1.612730	5364320.38	195666790.0	43609.46

DATABASE AND AREA TOTALS

DATA BASE IS EXCLUDER TRAWL GENERAL AREA IS SOUTH ATLANTIC

NUMBER OF TOWS IS 4212 NUMBER OF TURTLES IS 269

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.044616	26.3433	278.07	2.4418
VARIANCE	0.043651	1254.0393	237483.47	0.7695
SUM OF X	187.922127	110958.06	1171239.9	10284.85
SUM OF X2	192.199005	8203763.25	1325732064.0	28353.92

DATA BASE IS EXCLUDER TRAWL GENERAL AREA IS WEST FLA COAST

NUMBER OF TOWS IS 535 NUMBER OF TURTLES IS 7

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.006526	26.8676	243.24	3.9875

VARIANCE	0.003497	353.8273	352753.62	2.8020
SUM OF X	3.491667	14374.14	130134.9	2133.32
SUM OF X2	1.890391	575141.88	220024826.0	9896.34

DATA BASE IS EXCLUDER TRAWL GENERAL AREA IS NORTHEAST GULF

NUMBER OF TOWS IS 0 NUMBER OF TURTLES IS 0

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.	0.	0.	0.
VARIANCE	0.	0.	0.	0.
SUM OF X	0.	0.	0.	0.
SUM OF X2	0.	0.	0.	0.

DATA BASE IS EXCLUDER TRAWL GENERAL AREA IS NORTHWEST GULF

NUMBER OF TOWS IS 1753 NUMBER OF TURTLES IS 7

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.001522	31.6617	164.75	3.9768
VARIANCE	0.000720	1302.9926	46491.29	3.0988
SUM OF X	2.668404	55502.92	288803.7	6971.42

SUM OF X2	1.265147	4040158.25	127032662.0	[illegible]

DATA BASE IS INCIDENTIAL CATCH   GENERAL AREA IS SOUTH ATLANTIC

NUMBER OF TOWS IS 603   NUMBER OF TURTLES IS 110

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.045546	36.2775	207.07	2.4263
VARIANCE	0.014773	3680.7743	243107.66	0.8848
SUM OF X	27.464419	21875.33	124864.6	1463.03
SUM OF X2	10.144380	3009408.69	172206812.0	4082.36

DATA BASE IS INCIDENTIAL CATCH   GENERAL AREA IS WEST FLA COAST

NUMBER OF TOWS IS 56   NUMBER OF TURTLES IS 2

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.008205	28.4382	193.22	4.5506
VARIANCE	0.002241	1293.5042	144619.71	7.7110
SUM OF X	0.459490	1592.54	10820.2	254.83

SUM OF X2	0.127027	116431.78	10044722.0	1583.75

DATA BASE IS INCIDENTIAL CATCH GENERAL AREA IS NORTHEAST GULF

NUMBER OF TOWS IS 484 NUMBER OF TURTLES IS 6

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.005147	39.1324	447.20	2.7530
VARIANCE	0.002387	1652.7131	547220.54	2.4109
SUM OF X	2.491311	18940.08	216444.8	1332.45
SUM OF X2	1.165750	1539431.34	361101620.0	4832.70

DATA BASE IS INCIDENTIAL CATCH GENERAL AREA IS NORTHWEST GULF

NUMBER OF TOWS IS 476 NUMBER OF TURTLES IS 10

	TURTLES	SHRIMP	LIVE CATCH	HRS FISHED
MEAN	0.003725	34.1453	256.63	4.2253
VARIANCE	0.000718	1619.3555	74285.51	4.1221
SUM OF X	1.773058	16253.16	122155.2	2011.25
SUM OF X2	0.347583	1324162.86	66634144.0	10456.15

RATES NORMALIZED TO 100 FT. NET AND HOUR TON TIME

GRAND TOTALS BY SPECIES

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	380	16	4	0
MEAN	0.0256835	0.0013881	0.0001510	0.
VARIANCE	0.0233716	0.0012574	0.0000519	0.
SUM OF X	208.5239906	11.2702961	1.2261776	0.
SUM OF X2	195.0864773	10.2228681	0.4219000	0.

TOTALS BY AREA AND SPECIES

SOUTH ATLANTIC

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	356	12	3	0
MEAN	0.0417235	0.0019635	0.0002052	0.
VARIANCE	0.0381375	0.0019028	0.0000758	0.
SUM OF X	200.8984661	9.4544405	0.9880824	0.
SUM OF X2	191.9761581	9.1787128	0.3652107	0.

WEST FLA COAST

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	9	0	0	0
MEAN	0.0066855	0.	0.	0.
VARIANCE	0.0033746	0.	0.	0.
SUM OF X	3.9511572	0.	0.	0.
SUM OF X2	2.0174161	0.	0.	0.

NORTHEAST GULF

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	3	0	0	0
MEAN	0.0026588	0.	0.	0.
VARIANCE	0.0011958	0.	0.	0.
SUM OF X	1.2868575	0.	0.	0.
SUM OF X2	0.5810156	0.	0.	0.

NORTHWEST GULF

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	12	4	1	0
MEAN	0.0010711	0.0008147	0.0001068	0.

VARIANCE	0.0002286	0.0004680	0.0000254	0.
SUM OF X	2.3875106	1.8158557	0.2380952	0.
SUM OF X2	0.5118851	1.0441553	0.0566893	0.

RATES NORMALIZED TO 100 FT. NET AND HOUR TOW TIME

TOTALS BY DATABASE,AREA AND SPECIES

DATA BASE IS EXCLUDER TRAWL GENERAL AREA IS SOUTH ATLANTIC

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	250	11	1	0
MEAN	0.0414242	0.0021711	0.0000961	0.
VARIANCE	0.0416223	0.0021522	0.0000389	0.
SUM OF X	174.4786472	9.1446831	0.4047491	0.
SUM OF X2	182.4992905	9.0827632	0.1638218	0.

DATA BASE IS EXCLUDER TRAWL GENERAL AREA IS WEST FLA COAST

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	7	0	0	0
MEAN	0.0065265	0.	0.	0.
VARIANCE	0.0034974	0.	0.	0.
SUM OF X	3.4916674	0.	0.	0.
SUM OF X2	1.8903915	0.	0.	0.

DATA BASE IS EXCLUDER TRAWL GENERAL AREA IS NORTHEAST GULF

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	0	0	0	0
MEAN	0.	0.	0.	0.
VARIANCE	0.	0.	0.	0.
SUM OF X	0.	0.	0.	0.
SUM OF X2	0.	0.	0.	0.

DATA BASE IS EXCLUDER TRAWL GENERAL AREA IS NORTHWEST GULF

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	4	3	0	0
MEAN	0.0005512	0.0009710	0.	0.
VARIANCE	0.0001332	0.0005877	0.	0.
SUM OF X	0.9661843	1.7022194	0.	0.
SUM OF X2	0.2339047	1.0312421	0.	0.

DATA BASE IS INCIDENTIAL CATCH GENERAL AREA IS SOUTH ATLANTIC

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	106	1	2	0

MEAN	0.0438140	0.0005137	0.0009674	0.
VARIANCE	0.0138194	0.0001591	0.0003336	0.
SUM OF X	26.4198134	0.3097574	0.5833333	0.
SUM OF X2	9.4768629	0.0959496	0.2013889	0.

DATA BASE IS INCIDENTIAL CATCH GENERAL AREA IS WEST FLA COAST

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	2	0	0	0
MEAN	0.0082052	0.	0.	0.
VARIANCE	0.0022410	0.	0.	0.
SUM OF X	0.4594898	0.	0.	0.
SUM OF X2	0.1270266	0.	0.	0.

DATA BASE IS INCIDENTIAL CATCH GENERAL AREA IS NORTHEAST GULF

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	3	0	0	0
MEAN	0.0026588	0.	0.	0.
VARIANCE	0.0011958	0.	0.	0.
SUM OF X	1.2868575	0.	0.	0.
SUM OF X2	0.5810156	0.	0.	0.

DATA BASE IS INCIDENTIAL CATCH GENERAL AREA IS NORTHWEST GULF

	LOGGERHEAD	RIDLEY	GREEN	HAWKSBILL
NUMBER	8	1	1	0
MEAN	0.0029860	0.0002387	0.0005002	0.
VARIANCE	0.0005763	0.0000271	0.0001191	0.
SUM OF X	1.4213263	0.1136364	0.2380952	0.
SUM OF X2	0.2779804	0.0129132	0.0566893	0.